

facilities to carry out this work including an infrared spectrometer, Beckman DU and DK for visible and ultraviolet work, etc. Equipment for this kinetic work was constructed during the summer of 1959 thanks to a TIRC grant. Ultrasonic equipment has recently been acquired. A cobalt-60 source is available at the university.

9. Additional Requirements: Some additional infrared cells and sampling equipment as well as replacement parts for the infrared are required. Modest expendable supplies cover the cost of chemicals, glassware and miscellaneous.
10. Additional Information (Including relation of work to other projects and other sources of supply):

A study of the reaction of oxygen with pyrrole is now underway under NSF sponsorship. The mechanism of this reaction is under investigation by a kinetics study, both in the presence and absence of initiators and antioxidants. We are interested in isolating peroxy intermediates believed to be present. The initiation of the reaction in the absence of a free-radical source is under study as some evidence indicates the possibility of oxygen complexes although the existance of a magnetic perturbation (by  $O_2$ ) causing a forbidden singlet-triplet transition can not be ruled out.

We believe that the reaction of oxygen with nicotine is of importance in tobacco technology and that non-enzymatic, and non-bacterial reaction accounts for an important part of the fate of nicotine in tobacco processing. More information on this physical-chemical reaction is therefore needed.

/s./ Robert H. Linnell  
Director of Project

/s./ John T. Fey, President  
Business Officer of the Institution

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Committee:  
Dr. Jacobson  
Dr. Wilson  
Dr. Little  
(Dr. Parmelee)

TOBACCO INDUSTRY RESEARCH COMMITTEE

150 East Forty Second Street, New York 17, N.Y.

#264

Cr. #240

Activated 7/1/1959  
for 3 months.

Application For Research Grant

Date: February 5, 1960

1. Name of Investigator: Robert H. Linnell, Ph.D.

2. Title: Associate Professor of Chemistry

3. Institution & Address: University of Vermont, Burlington, Vermont

4. Project or Subject: The Autoxidation of Nicotine

5. Detailed Plan of Procedure:

The rate of oxygen uptake for solutions of nicotine will be determined in the presence of an initiator, such as Azodi-iso-butyronitrile and in the presence or absence of several inhibitors, including known nicotine degradation products (cotinine and its hydrolyzed form  $\gamma$ -(3-pyridyl) -  $\gamma$ -methylamino butyric acid). By using various temperatures a detailed kinetic scheme should be worked out. We will attempt to prepare peroxy compounds of nicotine by using lower temperatures (dry ice and higher) and initiation by, a) ultrasonics, b) Gamma rays from Co-60. Infrared will be used to seek the hydroperoxide of nicotine and study its conversion to cotinine. We find that the analysis of cotinine by infrared is feasible so this method will be used. A summary of our work is enclosed with this request.

possible up-titration of  
M. Kinnis work at M.C.U.

6. Budget Plan:

Salaries	\$3,500.00
Expendable Supplies	532.60
Permanent Equipment	600.00
Overhead (15%)	717.40
Other (Travel)	150.00
Total	\$5,500.00

7. Anticipated Duration of Work: The funds requested are to cover the period June 15, 1960 - September 15, 1961.

8. Facilities and Staff Available: The major part of the salary request (\$3150.00) is to cover a research fellowship for the stated period. This fellowship will allow a student to devote his major efforts to this research and to obtain an M.S. degree in chemistry with this work as his thesis. The chemistry department has the necessary laboratory

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